Full name: _____

Teacher: _____

Due date: _____

Orange High School

Year 12 Standard 2 Mathematics

Task 3 Investigative Assignment 2019

Outcomes Assessed
MS2-12-8 solves problems using networks to model decision-making in practical problems.
MS2-12-9 chooses and uses appropriate technology effectively in a range of contexts, and applies critical thinking to recognise appropriate times and methods for such use.
MS2-12-10 uses mathematical argument and reasoning to evaluate conclusions, communicating a position clearly to others and justifying a response.

Weighting 25%	**Due:** This assignment is due to your classroom teacher 2 weeks from the date received (Term 2 Week 5).

Penalties as per assessment booklet
Failure to submit the assignment within the negotiated timeframe may result in an N-award in Standard 2 Mathematics.

Year 12 Standard 2 Mathematics Investigative Assignment

Nature of the task

This investigative assignment involves the use of network concepts in a real-life context. You are required to develop your own network with specific criteria based on a location(s) you are familiar with. You will then need to propose a problem and solve it using your network. Knowledge of all terminology used in this topic will be needed to assist you.

Hand-in components of this task

Students will be handing in the following item:

- A hard copy of your typed report with network diagrams (either hand drawn or created using technology) which addresses all of the criteria outlined in this booklet.

Marking criteria

A marking rubric is provided at the back of this booklet.

You will be assessed on how well you:

- Accurately solve a variety of problems based on the scenario.

- Select and use appropriate mathematical processes, technologies and language to investigate, organise and interpret networks.

- Provide reasoning and justification related to the problems.

Feed forward provided by your teachers

You may seek feed forward from your teacher to aid in your understanding of Networks terminology and to outline areas for improvement before submitting your final product.

Task Outline:

In this topic you have studied ways of solving several different types of network problems. For this investigation you are required to devise a network problem of your own, set in a context from your local environment. For the purposes of this investigation, 'local environment' means somewhere you are familiar with – it could be in your home or school grounds, local town or it could include the whole state or country. This will depend on the problem you choose to solve. Your mathematical investigations will be recorded in a report. The suggested format for the report is provided on page 5 in Part 4 of the assignment.

Part 1: Design a Network (13 marks)

You have a lot of choice in this part of the task. Some possible examples are given below to get you started. You can also design your own network in a completely different context to the examples suggested below.

You are to design a real world network. It must include the following criteria exactly:

- 8 vertices
- 14 edges
- Minimum of 2 vertices with a degree of 4
- Connected
- Weighted edges reflecting real world distances/time/cost (this will depend on your context)

Additionally, you must:

- Draw a Weighted Table of your network
- Draw an Isomorphic Graph of your network
- Draw a Minimal Spanning Tree for your network. This needs to be drawn as a separate diagram and not highlighted on top of your original network diagram.
- Include a short one paragraph description of where your network is located and what it is about.

Example 1: The students at your school have requested that drinking fountains fed from a rainwater tank be placed at convenient places around the grounds. Using a map of the school, decide where the fountains would be located and how they can be connected to the tank.

Example 2: You are planning a road trip between two major cities in Australia (or towns in your state). There are several routes that can be taken without backtracking.

Part 2: Propose a Problem in Your Network and Solve it (10 marks)

a) Propose a real world problem in your network from Part 1 that needs to be solved. Use the examples below to help you propose a problem.

Your network problem must incorporate:

   • A Circuit
   • Travel along at least 7 edges

Example 1: Determine how the water fountains can be connected in the most cost efficient way while following the above criteria.

Example 2: Determine the best route on a round trip road journey using a variety of different costs (such as distance, time, road conditions, etc.) along each of the edges of the road network.

b) Solve your problem and include the following:

   • Shortest Path to solve your problem
   • All working out
   • Research you conducted to solve the problem such as prices of resources (pipes, labour prices per hour, fuel consumption of a car, petrol price per litre etc.)
   • Note: include a bibliography of websites used at the end of your report

Part 3: Investigate the effects of possible changes (7 marks)

a) Create one real life change that could possibly happen to your Part 2 problem.

b) Make a prediction about the possible effect this change would have on the Part 2 problem. Show working out and include research you conducted to solve the problem with this change.

Use the examples below to help you create a possible change.

Example 1:
You have run out of pipe that you bought from the hardware store. When you go back to buy more, the product is no longer available. A similar pipe in a different brand is available but it is more expensive.

Example 2:
A road is closed for roadworks meaning you have to change the route on your road trip to get to the same destination.

Part 4: Mathematical Report (10 marks)

Your report needs to be typed and printed upon submission to your classroom teacher. <u>Digital copies on a USB will not be accepted.</u> Network diagrams can either be hand drawn or created using technology. Ensure correct punctuation and grammar are used in your report.

Your report should include:

- Part 1 – network diagram, weighted table, isomorphic graph, minimal spanning tree and a clear description of the context of your network (i.e. where it is and what it is all about).
- Part 2 – the problem or question you propose to solve with a circuit and covers 7 edges, how you solved your problem showing all working out, a summary of the research you conducted with resources required to solve your problem, and a clear answer as the shortest path to your problem.
- Part 3 – one change that could happen to your network that effects your Part 2 answer. Outline the effect(s) it has on your original problem. Show all working out, a summary of the research you conducted and resources required to solve your new problem.
- Bibliography.

Marking Rubric

Outcomes	MS2-12-8	solves problems using networks to model decision-making in practical problems.
	MS2-12-9	chooses and uses appropriate technology effectively in a range of contexts, and applies critical thinking to recognise appropriate times and methods for such use.
	MS2-12-10	uses mathematical argument and reasoning to evaluate conclusions, communicating a position clearly to others and justifying a response.

Fluency Communication Understanding	Part 1 Constructs a **network diagram** correctly containing:			
	- 8 vertices	0	1	
	- 14 edges	0	1	
	- Min. 2 vertices with deg = 4	0	1	
	- Connected	0	1	
	- Weighted edges	0	1	
	- Weighted Table	0	1	2
	- Isomorphic Graph	0	1	2
	- Minimal Spanning Tree	0	1	2
	- Clear one paragraph description of network location and context	0	1	2
	Part 2 **Proposes a problem within the network and solves it** to model practical problems.			
	a) Comprehensive question proposed	0	1	2
	- Includes a Circuit	0	1	
	- Includes travel along at least 7 edges	0	1	
	b) Solution to problem shows:			
	- Shortest Path	0	1	2
	- Appropriate working out	0	1	2
	- Concise summary of research with a list of resources needed to solve the problem	0	1	2
Problem Solving Reasoning Justification	Part 3 Applies critical thinking and reasoning to:			
	- Determine **one change**	0	1	
	- Outline the **effect(s)** of the change	0	1	2
	- Appropriate working out shown	0	1	2
	- Summary of research and resources needed to solve the problem	0	1	2
	Part 4 The mathematical report:			
	- **typed** and **well presented**	0	1	2
	- neat **diagrams drawn with a ruler/technology**	0	1	2
	- uses **appropriate terminology**	0	1	2
	- **grammar and punctuation** are correct	0	1	2
	- **bibliography** included	0	1	2

Teacher's comment:			out of 40
		Total:	